

REMARKS

This application has been reviewed in light of the Office Action dated July 8, 2004. Claims 1 and 3-15 are pending in this application. Claim 2 and 16-21 have been canceled, without prejudice or disclaimer of subject matter. Claim 1, 4, and 10, which are in independent form, have been amended to define still more clearly what Applicants regard as their invention. Favorable reconsideration is requested.

The Office Action rejected Claims 1-7 and 10-13 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,571,749 (Matsuda et al.) in view of U.S. Patent No. 6,028,264 (Yamazaki (hereinafter Yamazaki '264)) and in view of U.S. Patent No. 5,556,794 (Yamazaki (hereinafter Yamazaki '794)); rejected Claims 8 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Matsuda et al. in view of Yamazaki '264 and in view of Yamazaki '794, as applied to Claims 1-7 and 10-13, and further in view of Japanese Patent Application Laid-Open No. 2000-77694 (Makoto and corresponding U.S. Patent No. 6,252,158 (Higashikawa)); and rejected Claims 9 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Matsuda et al. in view of Yamazaki '264 in view of Yamazaki '794, as applied to Claims 1-7 and 10-13, and further in view of Japanese Patent Application Laid-Open No. 11-310495 (Takaharu and corresponding U.S. Patent No. 6,103,138 (Kondo)). Applicants respectfully traverse these rejections.

The Office Action rejected Claims 1-7 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-4 of U.S. Patent No. 6,706,335 Yamazaki '264 and Yamazaki '794. Applicants respectfully traverse this rejection.

Applicants submit that amended independent Claims 1, 4, and 10, together with the remaining claims dependent thereon, are patentably distinct from the proposed combination of the cited prior art at least for the following reasons.

The aspect of the present invention set forth in Claim 1 is a process for forming a silicon-based thin film containing crystalline phase by high-frequency plasma chemical vapor deposition. The process provides a material gas containing silicon fluoride and hydrogen, and oxygen atoms are incorporated in the material gas at a concentration of from 0.1 ppm to 0.5 ppm based on that of a silicon atom. The process of providing the material gas is performed so that hydrogen in the material gas is fed at a flow rate not lower than flow rate of the silicon fluoride.

Among other important features of Claim 1 is that a silicon-based thin film containing crystalline phase is produced using a material gas containing a predetermined concentration of oxygen. The process of forming a silicon-based thin film containing crystalline phase having the features recited in Claim 1 forms at a high speed a high quality silicon thin film with excellent crystallinity.

Matsuda et al. relates to a method and apparatus for forming a deposited film. Matsuda et al. discusses the production of silicon thin film using plasma CVD, and that SiF₄ and O₂ are contained in the material gas.

Yamazaki '264 relates to a semiconductor having a low concentration of carbon. Yamazaki '264 discusses that oxygen is reduced lower than a predetermined concentration. An object of Yamazaki '264 is to intensify photo-sensitivity and to reduce Staebler-Wronski effect (see, e.g., col. 3, lines 11-20). Yamazaki '264 also discusses that a concentration of an impurity such as oxygen is reduced to achieve the objects. In fact,

there is a discussion in the BACKGROUND OF THE INVENTION that conventional, non-single crystalline silicon film contains oxygen with a concentration above 10^{20} atom/cm³ (see, e.g., col. 1, line 66, to col. 2, line 9).

Yamazaki '794 relates to a method of manufacturing a semiconductor device having low sodium concentration. Yamazaki '794 discusses that photo-sensitivity is low and that instability occurs when, for example, sodium, oxygen or the like contained in concentration of 10^{20} atoms/cm³ or more generates dangling bonds and the dangling bonds act as recombination centers of the photo carriers, and the loss of the photo carriers generated in the layer increases (see, e.g., col. 2, lines 31-49 to col. 3, lines 12-17).

Applicants submit, however, that nothing has been found in the cited prior art, when taken separately or in any proper combination (assuming such combination would even be permissible), that would teach or suggest that a silicon-based thin film containing crystalline phase is produced using a material gas containing a predetermined concentration of oxygen, as recited in Claim 1.

Accordingly, at least for these reasons, Claim 1 is patentable over the cited prior art, when taken separately or in any proper combination (assuming such combination would even be permissible).

Independent Claims 4 and 10 include the same features of a silicon-based thin film containing crystalline phase and a material gas containing a predetermined concentration of oxygen, as discussed above in connection with Claim 1. Accordingly, Claims 4 and 10 are believed to be patentable for at least the same reasons as discussed above in connection with Claim 1.

Applicants further submit that Claims 1-4 of Kondo et al., Yamazaki '264,

and Yamazaki '794, do not recite the features of amended Claims 1 and 4, thus the double patenting rejection of these claims has been obviated, and Applicants respectfully request its withdrawal.

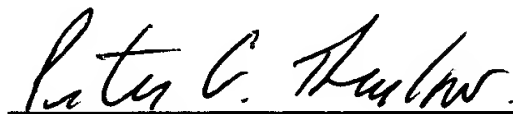
A review of the other art of record, including Makoto and Takaharu, has failed to reveal anything that, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as applied against the independent claims herein. Therefore, those claims are respectfully submitted to be patentable over the art of record.

The other rejected claims in this application depend from Claims 1, 4, or 11 discussed above, and, therefore, are submitted to be patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and the allowance of the present application.

Applicants' undersigned attorney may be reached in our New York Office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

A handwritten signature in black ink, reading "Peter G. Thurlow", written over a horizontal line.

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